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METHODS OF AND SYSTEMS FOR ADDING A HIGH VISCOSITY GYPSUM ADDITIVE TO A POST-MIXER AQUEOUS DISPERSION OF CALCINED GYPSUM

CROSS-REFERENCE TO RELATED APPLICATIONS

This patent application is a divisional patent application of U.S. patent application Ser. No. 11/116,809, filed Apr. 27, 2005 now U.S. Pat. No. 8,016,960, which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

Set gypsum (calcium sulfate dihydrate) is a well-known material that is included commonly in many types of products, such as gypsum board employed in typical drywall construction of interior walls and ceilings of buildings. Typically, gypsum-containing board is prepared by forming a mixture of calcined gypsum, that is, calcium sulfate hemihydrate and/or calcium sulfate anhydrite, and water, as well as other components, as desired. The mixture typically is cast into a pre-determined shape on the surface of a conveyor or in a tray. As it travels along the conveyor, the calcined gypsum reacts with water to form a matrix of crystalline hydrated gypsum or calcium sulfate dihydrate. The desired hydration of the calcined gypsum is what enables the formation of an interlocking matrix of set gypsum crystals, thereby imparting strength to the gypsum structure in the gypsum-containing product. Mild heating can be used to drive off unreacted water to yield a dry product. Gypsum mixers and methods of producing gypsum products are described, for example, in U.S. Pat. Nos. 1,767,791; 2,253,059; 2,346,999; 4,183,908; 5,683,635; 5,714,032; and 6,494,609.

Accelerator materials are commonly used in the production of gypsum products to enhance the efficiency of hydration and to control set time. Accelerators are described, for example in U.S. Pat. Nos. 3,573,947; 3,947,285; 4,054,461; and 6,409,825. Some accelerators include finely ground dry calcium sulfate dihydrate, known as "gypsum seeds." The gypsum seeds enhance nucleation of the set gypsum crystals, thereby increasing the crystallization rate thereof. Traditionally, accelerators have been added to the same mixer chamber as that used to combine water with calcined gypsum. While addition of accelerator to the mixer has the advantage of mixing the accelerator well and evenly throughout the water and calcined gypsum mixture, the accelerator can also cause the gypsum to begin setting prematurely. Premature setting can cause the mixer to clog, can cause damage to the mixer, limits efficiency, and necessitates more frequent mixer cleaning. Mixer cleaning requires shutting down a board line with a serious detriment to productivity. Although additives including retarders have been used in the mixer to combat premature setting, such additives contribute additional costs and considerations.

Accordingly, new materials and methods are needed to aid in gypsum setting.

BRIEF SUMMARY OF THE INVENTION

According to one aspect of the preset invention, a method of introducing a wet gypsum accelerator (WGA) to a post-mixer aqueous dispersion of calcined gypsum is provided. An aqueous dispersion of calcined gypsum is formed in a mixer chamber of a stucco mixer and discharged into a discharge

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apparatus. WGA is introduced into the aqueous dispersion within the discharge apparatus.

According to another aspect of the preset invention, a method of introducing a high viscosity production additive to a post-mixer aqueous dispersion of calcined gypsum is provided. An aqueous dispersion of calcined gypsum is formed in a mixer chamber and discharged into a discharge apparatus. The high viscosity production additive is introduced into the aqueous dispersion within the discharge apparatus. The ratio of the viscosity of the high viscosity production additive to the aqueous dispersion is between about 10:1 to about 2:1.

A system for introducing a wet gypsum accelerator to a post-mixer aqueous dispersion of calcined gypsum is provided as an aspect of the present invention. The system includes at least a source of WGA; a delivery device; a mixer for forming an aqueous dispersion of calcined gypsum; a discharge apparatus operatively associated with an outlet of the mixer—the source, delivery device and the discharge apparatus operatively associated with each other.

For example, the present invention has particular utility in the preparation of gypsum board such as wallboard or ceiling tile. In such embodiments, after the high viscosity production additive such as WGA is added to the aqueous dispersion of calcined gypsum, the dispersion is deposited onto a moving coversheet. In the case of wallboard, a second coversheet is applied to the deposited contents prior to drying. In some embodiments, such as some ceiling tile, a second coversheet is not employed.

The present invention's methods, systems, and elements thereof are further described in the drawings and detailed description, which provide representative embodiments.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

FIG. 1 shows a schematic plan view of a system for adding a high viscosity gypsum additive to a post-mixer aqueous dispersion of calcined gypsum.

FIG. 2 shows a schematic cross-sectional view of part of the system shown in FIG. 1 comprising an injection ring with multiple injection ports.

FIG. 3 shows a variation on the schematic cross-sectional view of FIG. 2 incorporating a tee junction.

FIG. 4 shows a schematic plan view of a variation on the system shown in FIG. 1.

FIG. 5 shows a partial perspective view of a mixer and discharge apparatus.

FIG. 6 shows a perspective view of a first portion of a mixer discharge apparatus system.

FIG. 7 shows a perspective view of a second portion of a mixer discharge apparatus system.

FIG. 8 shows a schematic plan view of the system depicted in FIGS. 6 and 7.

FIG. 9 shows a schematic plan view of a variation of the system depicted in FIG. 8.

FIG. 10 shows a schematic plan view of a variation of the system depicted in FIG. 9.

While the invention is susceptible to various modifications and alternative constructions, certain illustrative embodiments thereof have been shown in the drawings and will be described below in detail. It should be understood, however, that there is no intention to limit the invention to the specific embodiments disclosed, but on the contrary, the intention is to cover all modifications, alternative constructions, and equiva-